
POWER WEEDER AND CROP CUTTER PROTOTYPE & DEVELOPMENT
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ABSTRACT

In the field of agriculture for better yielding, all the unwanted grass in the field should be removed as far as possible otherwise this unwanted grass will absorb all the nutrition in the soil and will lead to less crop production. Weeding is an important agricultural operation. Delay and negligence in weeding operation affect the lower crop yield. Weed control is one of the most difficult tasks in agriculture that accounts for a considerable share of the cost involved in agricultural production. Farmers generally expressed their concern for effective weed control measures to arrest the growth and propagation of weeds. Traditionally weeding is done with the help of pair of Bullocks, two men and a weeder set. At present, economic conditions of a farmers is not good, it is quite very expensive for small farmers to afford this set up of weeding. To overcome this problem the farmers are using chemical herbicides. Chemical control method of weed is more prominent than manual and mechanical methods. However, its adverse effects on the environment and human health are making farmers to consider and probably prefer mechanical method control. The use of mechanical weeder will reduce drudgery and ensures a comfortable posture of the farmer or operator during weeding. Traditional crop cutting, also known as manual crop cutting or hand harvesting, is a method of harvesting crops that involves manually cutting the crops from the plant using a knife or similar tool. This method of harvesting has been used for centuries and is still widely practiced in many parts of the world, particularly in developing countries where mechanized harvesting equipment is not affordable or readily available. Thus, farmers are using grass cutter machines to cut the crops faster, as the grass cutters are intended to cut the grass, they are very unsafe when used to cut the crops;

Keywords: Harvesting crops, Mechanized harvesting, Safety, Nutrition, Chemical herbicides, human health.

I. INTRODUCTION

A weed is essentially any plant which grows where It is unwanted. A weed can be thought of as any plant growing in the worn place at the wrong time and doing more harm than good. It is a plant that competes with crops for water, nutrients, and light. This can reduce crop production. Some weeds have beneficial uses but not usually when they are growing among crops. Weeds decrease the value of land, particularly perennial weeds which tend to accumulate on long fallows; increase cost of cleaning and drying crops. Weeding is the removal of unwanted plants in the field crops. Mechanical weed control is very effective as it helps to reduce efforts involved in manual weeding, it kills the weeds and also keeps the soil surface loose ensuring soil aeration and water intake capacity Weeding is an important but equally labor intensive agricultural unit operation. The goal of good harvesting is to maximize crop yield and minimize any crop losses and quality deterioration. Harvesting can be done manually, using hands or knives and it can be done mechanically with the use of rippers, combine harvesters or other machines. There are four harvesting systems that use farmers all over the country: A) Manual system; includes the use of traditional tools (hand cutting, hand threshing, animals for trampling)

B) Manual harvesting with machine threshing; combination of manual and machine power

C) Machine harvesting with machine threshing; possible use of manual power

D) Combine harvesting; all harvesting operations are done with combine, no need for manual power. It's the most efficient tool, results in the lowest losses but it's expensive and requires large field areas

II. LITERATURE REVIEW

C. R. Mehta, et al [1] discussed about Economic growth in Indian agricultural sector lags behind growth in industry and services, creating an ever widening rural-urban income gap and presented study on agricultural mechanization in asia, africa, and latinAmerica Dominic Merriott [2] presented study on farmer suicide crisis in India , and found Socioeconomic factors, rather than mental health problems, are associated with farmer suicides, with increased indebtedness playing the predominant role. Available research suggests this has arisen to a greater extent recently, due to an agrarian crisis affecting the most vulnerable farmers Yogita Gharde,et al [3] concluded that Potential yield losses due to weeds were calculated with the help of yield data. It showed that potential yield loss was very high in case of soybean which experienced about 50–76% yield reduction followed by groundnut where 45–71% yield loss was recorded due to weeds. High variation in the yield losses were observed among the different states S.K. Srivastava,et al[4] ,studied and shared the findings:- The evidences from census and NSSO surveys clearly point out rising trend in employment diversification from agriculture to non-farm sectors. NSSO surveys have reported relatively higher rate of decline in participation of agricultural workers as compared to census. This is primarily accounted by wide variation and contrary trend in the estimates of agricultural labours from these data sources. The 2001-census estimates of agricultural labours were 20 per cent higher than 2004/05-NSSO estimates, and the gap further widened to 50 per cent by 2011-12. M.S.H. Mandal,et al [5]Concluded Weed control methods played a vital role for the growth and yield of wheat. Among the weed control methods, Sunrice 150WG was found the best for controlling weeds as post emergence. Chemical herbicide Sunrice 150WG @ 100 g/ha applied as early post-emergence will be promising weed control practice for obtaining optimum wheat grain yield. Naveen Kumar, et al [6] described how All herbicides & pesticides have the potential to-be harmful to humans, animals, other living organisms, and the environment if used incorrectly. The key to reducing health hazards when using pesticides is to always limit your exposure, Alternative methods should be applied for weed control S.V. Shamkuwar et al[7] discussed & compared various weed control methods and concluded many self-propelled and tractor drawn weeding machine have been developed for weeding operation for medium and large farmer, but little work has been carried out for small and marginal farmers. Thus, there is need to develop an efficient weeding machine for small and marginal farmers. Dr. AK Dave ,et[8] al have developed & evaluated Performance of manually operated weeder .concluded, that the performance of developed mono wheel operated sprayer cum weeder is superior in terms of time and cost requirement to that of conventional weeding using manually operated knapsack sprayer and Khurpi Krishnadas R, RenganathanR [9]found The use of a power tiller expedites agricultural activities, resulting in higher output, productivity, and cropping intensity. Nevertheless, a number of obstacles stand in the way of the widespread adoption of power tiller mechanization, including a lack of public awareness of the corresponding implement, the arduous nature of its use, the scarcity of adequate training on these topics, as well as inadequate support from financial institutions and the government. That is why the future of Indian agriculture lies with power tillers and other agricultural equipment. Dadaso D Mohite,et al[10] have developed Weed cutter machine which pulverizes the soil around the crops also have same precautions to deal with like :-Don't let operators' consideration slip while operator is utilizing the Brush Shaper. Ensure that operator keep a solid hold on the machine with two hands and get the sharp edge or cutting string far from operators' body. & It is perilous to compel the brush shaper at unnecessary rates. So don't cut a speed that the brush shaper can't deal with. SuryakantaKhandai, et al [11] discussed about Manual harvesting; Sickle is the main equipment used for manual harvesting having several issues. Manual harvesting is mainly labour-intensive and time-consuming operation. Many studies revealed that drudgery is one of the major issues of manual harvest, and mostly women farmers are involved in this operation. PurviTiwari ,et al [12] did rigorous study on manual threshing operation and developed pedal operated thresher for tribal women of bastar ; ways of threshing are strenuous and labourintensive, but preferably performed by women. Hand beating of crop could be performed using stick to avoid discomfort. However, taping of crop under feet expose feet to sharp edges of crop kernels and bundles thereby feet prone to pierce and injured along with the fall down of workers. Further, such methods often lead to grain loss due to shattering. Hand beating and bullock treading are common to thresh wheat and paddy crop MK Charwak,et [13] al have developed special purpose

reaper type crop cutter machine which cost upto Rs. 15000, the machine consists of two mechanisms one is a Crank and Slotted Lever Mechanism for reciprocation of cutter blade over stationary cutter blade and this mechanism is used to convert rotary motion into linear motion. Second is collecting mechanism which consist chain sprocket and motorcycle chain Shreemat Shrestha, et al[14] did study on Utilization of the combine harvesters in Nepal (same is applicable in india) and found ; almost all the surveyed service provider (21 out of 22) owned self-propelled combine harvester whereas only one service provider at Far western cluster owned tractor mounted combine harvester. To operate each combine harvester, 3 to 6 persons (1 driver, 1-2 mechanic/helper and 1- 3 marketing assistant) are found to be involved by the surveyed service providers. Most of the combine harvester drivers and mechanics are found to be Indian. It is found that the Indian operator/ mechanic charge at the range of from Rs. 90,000 to Rs. 240,000 (in average Rs. 152 thousand Nepalese Rupees) in one harvesting season. Along with the benefit of combine harvesters, there are some issues regarding the straw burning, lack of farm roads for combine use, lack of trained technicians/ operator, registration of combine, high cost of spare parts, financing of combine harvester etc O. B. Falana, et al[15]modified the grass cutter machine and found that kenaf harvester used in this study reduced harvest losses due to the stubble height on the field. However, this can only be achieved where there are little or no stumps and stones that could damage the kenaf harvester blade

III. DESIGN

The main focus is especially on soyabean crop for the development of power weeder as the heightof soybean crop is about 1 feet, there is no need for higher ground clearance

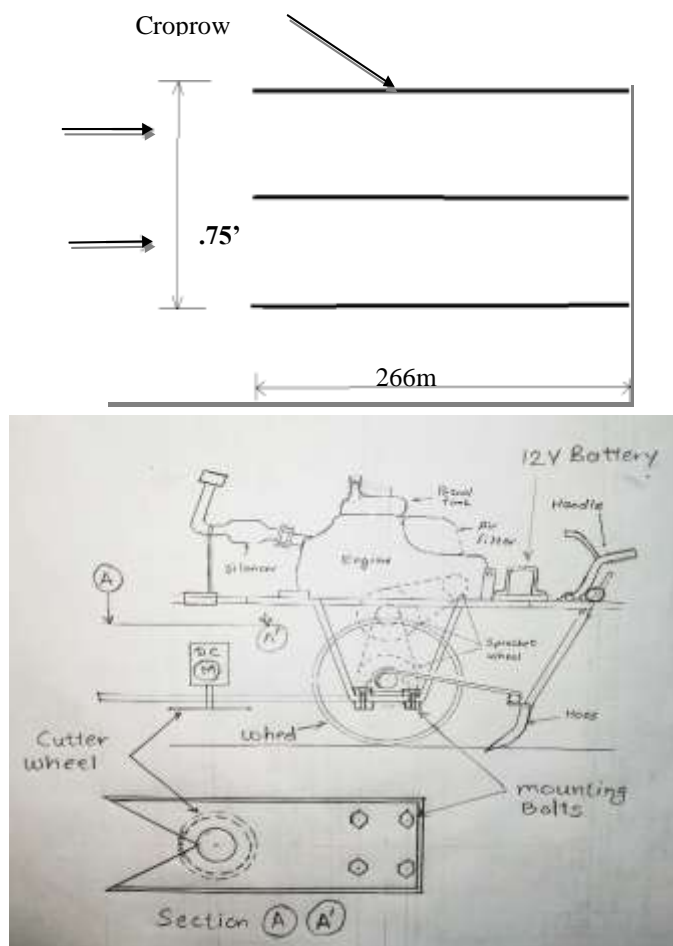


Figure 1: Concept drawing

Design considerations for Speed reduction involves the speed of the weeder by which It will propel on the soil and its hold not pull the mandrivingtheweeder,sothespeedoftheweeder shouldnotbegreaterthan-thespeedofthemanwalkinginthefieldagaintheengine readily available have the maximum speed of 3000 rpm and the average working speed of 1500 rpm hence therequirementistoreducethe3000rmtowalkingspeedofmaninthefarm.

Calculations made:- Theare acover edinonetreturnoftheweeder For completed coverage of area in the filled area to be cover in one go is calculate as $266 * 0.75m = 199.50 = 200sqm$

THE TOTAL AREA TO BE COVERED IN ONE ACRE IS

1 ACRE = 40 Are = $40 * 10 * 10 = 4000sqm$

Turns required cover the total area in 1 acre

Total area /area covered in one turn = $4000/200 = 20$ turns

NOW distance travelled in 20 turn is

=Distance travelled in one turn * total turns

= $266 * 20$

= 5320m

i.e. 5.3km

Let the total distance travelled in one acre is 5.5km

FOR FUEL CONSUMPTION- AS the average of the engine is 10km/literAnd for one acre distances travelled is 5.5km

$10/1 = 5.5/x$ thus

$X = 5.5/10$

$X = 0.550$ liter

i.e. = 550ml

fuel required is 550ml.

Now a considering all the losses, time of idling, engine fluctuation, power developed vaporization of fuel , distance travelled in turing of the weeder and efficiency of engine , soil condition and factor of safety .

The consumption can go up to approx. 1 liter /Acre

TIME REQUIRED FOR WEEDING 1 ACRE- Generally average man walks with the speed of 7-8km/hrs On the road, but when considering the farm, the speed get reduced to 3km/ hrs because of uneven land, crop, and also weeds, Thus, Average human walking speed is 3km/hrs in the farm i.e.3000m/hr

the speed of the weeder so design that it will also run at average speed of 3000 m/hrs. and the distance required to travelled in 1acre is 5.5kmi.e.5500m

HENCE

$5500/3000 = 1.833$ hr

Thus, time required for weeding one acre of farm 2hrswiil be required- Calculations for Power Transmission The power transmission unit will work in three stages. The first stage is the transmission of power from crank shaft to output shaft. The power is transmitted via. CVT(continuous variable transmission). In this stage the rpm is reduced from 3000 rpm to 1000 rpm. The second stage of power transmission involves the transmission of power from output shaft to the middle shaft. On the output shaft a sprocket no.1 is mounted, and on the iddle shaft sprocket no. 2 is mounted. The power transmission takes place using chain drive. In this stage the r.p.m. is reduced from 1000 rpm. to 250 rpm. The third stage of power transmission involves the transmission of power from middle shaft to the bottom shaft On the middle shaft the sprocket no. 3 is there, and on the bottom shaft the sprocket no.4 is mounted. The power transmission takes place using chain drive. In this stage rpm from 250 to 62.5r.p.m. is reduced, which further provides the motion to the wheels mounted on the same bottom shaft.

CALCULATION:

T1 = teeth on sprocket 1 & 3, = 14 teeth

T2 = teeth on sprocket 2 & 4, = 56 teeth

N1 = speed on crank shaft, N2 = speed on output shaft,

N3 = speed on middle shaft, N4 = speed on bottom shaft,

First stage,

Second stage,

3000 r.p.m. to 1000 r.p.m.

$$T1 \cdot N2 = T2 \cdot N3$$

N1= 3000 r.p.m.

$$14 \cdot 1000 = 56 \cdot N3$$

N2= 1000r.p.m.

$$N3 = 250r.p.m.$$

Third stage,

$$T1 \cdot N3 = T2 \cdot N4$$

$$14 \cdot 250 = 56 \cdot N4$$

$$N4 = 62.5r.p.m.$$

All the above calculation are carried out for full speed of 3000 r.p.m., but in reality the engine will be operated just above idling speed and can be easily controlled by accelerator thus Theoutput r.p.m. on the wheels of 25 r.p.m. will be easily obtained

IV. CONCLUSION

With this machine,

- 1) We will cut the crops with safety and fast in very low cost.
- 2) We are aiming to achieve work of TWO BULLS and TWO MEN by weeder.
- 2) No GEAR shifting will required, Hence anybody will able operate the weeder.
- 3) We will be equipped with SELF START & HANDLE START both.
- 4) It will be able to weed narrow row distance up to 15 inches ie 38 cm dense like SOYABEAN, GROUNDNUT.
- 5) For weeding 1 acre of area, weeder will requires one litre of fuel which will be much economic.

In short this machine will benefit farmers in crop cutting and weeding operation in agriculture

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